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Original Article

EFFECT OF DIFFERENT SPACINGS WITHIN A PAIR AND BETWEEN PAIRS ON GROWTH AND PRODUCTIVITY OF PIGEON PEA CROP [*CAJANUS CAJAN* (*L.*) MILLSP.] IN A PAIRED ROW PLANTING SYSTEM

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ABSTRACT

The study was carried out at Agricultural Research Station, Tandur, Professor Jayashankar, Telangana State Agricultural University (PJTSAU) for two consecutive years, viz., 2017–18 and 2018–19 to study the "effect of different spacings within a pair and between pairs on growth and productivity of pigeon pea crop [Cajanus cajan (L.) Millsp.] in a paired row planting system" on pigeon pea in split plot design comprising spacing within a pair as main plots (2 No.), i.e., M1: 45 cm and M2: 60 cm and spacing between two paired rows as subplots (4 No.), i.e., S1: 1.8 m, S2: 2.4 m, S3: 3.0 m and S4: 3.6 m with three replications). The experiment was carried out in vertisols (black-cotton soils). Two years of pooled analysis of the data revealed that we can go either 45 cm or 60 cm spacing within a pair, but the distance between two pairs must be 3.0 m to harvest higher red gram seed yield and net returns. S3 (distance between two pairs is 3.0 m) registered significantly higher seed yield of 2282 kg ha^{-1}, net returns of Rs. 1,14,420/- per hectare and B:C ratio (5.09) and it is followed by S4 (distance between two pairs is 3.6 m) with regard to seed yield (1983 kg ha^{-1}).

KEYWORDS: Paired Row Planting, Pigeon Pea & Spacing

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INTRODUCTION

Pigeon pea [*Cajanus cajan* (L.) Millsp.] is one of the major grain legume crops of the tropics and sub-tropics. Pigeon pea crop occupies 6.5% of the world's total pulse area, which contributes to 5.7% of the total pulse production. Of total world production, India is the largest producer of pigeon pea, accounting to about 64%. Among all the pulses, pigeon pea, a protein rich staple food, accounts for 14.5% in area and 15.5% in productivity. In India, pigeon pea ranks second in area, and 91% of the world pigeon pea is produced in India. In India, pigeon pea is cultivated in 53.38 L ha with a production of 48.73 L tonnes and with a productivity of 913 kg ha^{-1}. In Telangana, this crop was grown over an area of 3.86 L ha with a production of 2.61 L tonnes with productivity of 676 kg ha^{-1} [3].

Agronomic practice like plant population is known to affect crop environment, which influences the yield and yield components. Optimum population levels should be maintained to exploit maximum natural resources, such as nutrient, sunlight, soil moisture and to ensure satisfactory yield [5]. Paired row planting system allows timely weed management through appropriate farm mechanization options for having to plant the pairs wide enough. Forming soil much with intermittent intercultivation resulted in better soil moisture conservation and thereby avoided terminal drought stress. Due to good earthing up, it

is possible to prevent lodging. The system also permits better light interception by the crop and resource sharing for harvesting better yields [2]. It is time to know the correct spacing within a pair and between pairs to harvest highest red gram seed yields. Keeping in view the aforesaid issues, the study was taken to identify the effect of different spacings within a pair and between pairs on growth and productivity of pigeon pea in a paired row planting system.

MATERIALS AND METHODS

The field experiment was conducted on deep black cotton soils at Agricultural Research Station, Tandur, Vikarabad (Dist.), Telangana State of Professor Jayashankar Telangana State Agricultural University for two consecutive Kharif seasons, 2017–18 and 2018–19. The experimental site soil had P^H 8.2 with low available nitrogen (190.0 kg ha^{-1}), medium in available P (16.60 kg ha^{-1}) and high in available K (330.40 kg ha^{-1}) in all the above-mentioned years. The experiment was conducted in split plot design comprising spacing within a pair as main plots (2 No.), i.e., M1: 45 cm and M2: 60 cm and spacing between two paired rows as subplots (4 No.), i.e., S1: 1.8 m, S2: 2.4 m, S3: 3.0 m and S4: 3.6 m with three replications. Spacing between each plant within a pair was 30 cm. Recommended dose of fertilizers (20:50:10 NPK kg ha^{-1}) were used at the time of sowing. Data on various growth parameters was recorded periodically. Observations on five random plants from each plot were recorded for primary and secondary branches $plant^{-1}$, pods $plant^{-1}$ and seed pod^{-1}.

The gross plot size was 12 x 7m. The experimental data was analysed statistically by following Fischer's method of analysis of variance, as per procedure suggested by Gomez and Gomez (1984). F–test was significant at P = 0.05 and the results have been compared among treatments based on critical difference. The gross returns are worked out based on the prevailing market rate of pigeon pea seed (Rs. 60 per kg). The benefit cost ratio was worked out for different treatments by dividing the net returns by the corresponding cost of cultivation of the treatments.

RESULTS AND DISCUSSIONS

Experimental results (two years pooled data) of the trial on paired row planting of red gram indicated that spacing within a pair differed significantly with regard to plant height and primary branches, pods per plant while in the secondary branches, test weight and seed yield differed non-significantly (tables 1 and 2).

Table 1: Effect of Different Spacings between and within a Pair on Growth Parameters of Pigeon Pea in a Paired Row Planting System

Treatments	Plant Height (cm)			No. of Primary Branches $Plant^{-1}$			No. of Secondary Branches $Plant^{-1}$		
	2017–18	2018–19	Pooled	2017–18	2018–19	Pooled	2017–18	2018–19	Pooled
(A) Main Plots – Spacing within a Pair									
M1: 45 cm	245	141.2	193.1	2.05	2.4	2.2	23.4	21.5	22.0
M2: 60 cm	250	118.2	184.1	2.4	2.5	2.5	22.61	25.5	24.5
C.D (p = 0.05)	NS	20.1	20.1	0.32	0.32	0.3	NS	NS	NS
(B) Subplots – Spacing between Pairs									
S1: 1.8 m	221	304	177.2	2.1	2.10	2.1	21.5	21.4	21.4
S2: 2.4 m	238	335	183.5	2.30	2.30	2.3	22.8	23.4	21.9
S3: 3.0 m	258	430	194.5	2.13	2.12	2.1	23.2	25.4	24.3
S4: 3.6 m	274	465	199.5	2.36	2.34	2.4	20.6	26.1	23.4
C.D (p = 0.05)	NS	39.5	NS	0.27	0.27	0.3	2.37	3.63	3.0
Interaction (A X B)									
C.D (p = 0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 2: Effect of different Spacings between and within a Pair on Yield Parameters and Yield of Pigeon Pea in a Paired Row Planting System

Treatments	Number of Pods Plant^{-1}			Test Weight(g)			Seed Yield (kg ha^{-1})		
	2017–18	2018–19	Pooled	2017–18	2018–19	Pooled	2017–18	2018–19	Pooled
(A) Main Plots – Spacing within a Pair									
M1: 45 cm	189	342	265	9.51	9.59	9.59	1920	1709	1815
M2: 60 cm	316	390	353	9.81	9.87	9.67	2191	1950	2070
C.D (p = 0.05)	62.2	NS	62.2	NS	NS	NS	NS	NS	NS
(B) Sub-plots – Spacing between Pairs									
S1: 1.8 m	201	304	252	9.66	9.69	9.68	1709	1520	1615
S2: 2.4 m	249	335	292	9.67	9.76	9.75	2220	1673	1947
S3: 3.0 m	276	430	353	9.81	9.83	9.81	2415	2149	2282
S4: 3.6 m	219	465	382	9.91	9.65	9.64	1990	1976	1983
C.D (p = 0.05)	NS	39.5	39.5	NS	NS	NS	221	197	209.0
Interaction (A X B)									
C.D (p = 0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS

Of the two main plots, M1 (45 cm) recorded significantly higher plant height of 193.1 cm. M2 (60 cm) registered significantly more number of primary branches of 2.5 pods per plant (353), while it differed non-significantly with regard to test the weight (9.67 gm) and seed yield of 2,070 kg ha^{-1} which is on par with M1 (1815 kg ha^{-1}). M1 recorded highest net returns (Rs. 1,01,700 ha^{-1}) and benefit cost ratio of 4.52 (table 3).

Table 3: Effect of different Spacings between and within a Pair on Economics of Pigeon Pea in a Paired Row Planting System

Treatments	Gross Returns (Rs ha^{-1})			Net Returns (Rs ha^{-1})			B:C Ratio		
	2017–18	2018–19	Pooled	2017–18	2018–19	Pooled	2017–18	2018–19	Pooled
(A) Main Plots – Spacing within a Pair									
M1: 45 cm	115200	102540	108900	92700	80040	86400	4.12	3.56	3.84
M2: 60 cm	131460	117000	124200	108960	94500	101700	4.84	4.20	4.52
(B) Subplots – Spacing between Pairs									
S1: 1.8 m	102540	91200	96900	80040	68700	74400	3.56	3.05	3.31
S2: 2.4 m	133200	100380	116820	110700	77880	94320	4.92	3.46	4.19
S3: 3.0 m	144900	128940	136920	122400	106440	114420	5.44	4.73	5.09
S4: 3.6 m	119400	118560	118980	96900	96060	96480	4.31	4.27	4.29

With regard to subplot (spacing between pairs), there was non-significant difference in plant height and test weight, while the primary and secondary branches, number of pods per plant and seed yield differed significantly (tables 1 and 2).

Of the four subplots, S4 (3.6 m between pairs) recorded significantly higher plant height of 199.5 cm, primary branches (2.4), secondary branches (23.4) and highest number of pods, i.e., 382 pods per plant (tables 1 and 2).

Of the four subplots, S3 (3.0 m between pairs) registered significantly higher seed yield of 2282 kg ha^{-1}, net returns of Rs. 1,14,420 ha^{-1} and B:C ratio of 5.09, while it was followed by S4 (3.6 m between pairs) with regard to seed yield (1983 kg ha^{-1}) (tables 2 and 3). S2 (2.4 m between pairs) and S4 (3.6 m between pairs) were on par with each other in seed yield. Interaction between main plots and subplots were non-significant, hence only direct effects are depicted. Even though the number of pods per plant is more in S4 (3.6 m between pairs), the overall yield per unit area decreased due to decrease in the number of paired rows per unit area. Increase in spacing enhanced the individual plant performance. Further, it might have improved the rate of photosynthesis, dry matter accumulation and its translocation to pods, as referred in terms of higher values of growth and yield components that resulted in higher pod yield plant^{-1} of red gram with wider row spacing [4 and 6]. The better availability of

growth resources like water, nutrients, air, mulching, better cultural practices and effective weed control in wider plant geometry helped the plants to exhibit their full potential and produced higher yield than closely spaced plants [1 and 5].

CONCLUSIONS

It is concluded from the above trial that we can go either 45 cm or 60 cm spacing within a pair, but the distance between two pairs must be 3.0 m spacing to harvest higher seed yield and net returns.

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